



Massapequa Water District

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January 27, 2016

Ms. Nina M. Johnson
Department of the Navy
Naval Facilities Engineering Command, Mid-Atlantic
9324 Virginia Avenue Norfolk, VA 23511-3905

Ed Hannon
Northrop Grumman
925 South Oyster Bay Road
Bethpage, NY 11714

Subject: Monitoring Well Access for Compound Specific Isotope Analysis Bethpage, NY

Dear Ms. Johnson and Mr. Hannon:

Thank you for the Navy and Northrop Grumman response letters dated December 18, 2015 and January 5, 2016 responding to Massapequa Water District's (MWD) request for access to Navy & NG monitoring wells to perform Compound Specific Isotope Analysis (CSIA) sampling. MWD is pleased the Navy and NG has agreed to cooperate with our efforts to better identify the contamination source(s) which continues to threaten the pristine public water supply wells of MWD. MWD continues to receive sampling reports, provided by the Navy, which show increasing levels of contamination in several monitoring wells south of Hempstead Turnpike. It has long been the position of MWD (which is well documented) that the contamination plume has not been aggressively remediated to properly protect additional public supply wells from being contaminated. If anything, recent data upgradient in Bethpage confirms that contamination levels are significantly increasing. This is very alarming to downgradient suppliers such as MWD.

It has often been suggested by the Navy and Northrop Grumman, at meetings attended by the Navy, Northrop Grumman, NYSDEC, USEPA and the various water suppliers, that the source of the plume (including 1, 4 dioxane) may be from an additional source other than Navy or NG properties. This is the purpose of MWD's request; to conduct CSIA sampling for both TCE and 1, 4 dioxane. Consistent with statements at these meetings by MWD and in media reports (although the media seldom reports the full interview), our experts have advised MWD that the CSIA analysis can eliminate much of the speculation

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of the inhabitants of the Massapequa Water District*

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as to the source of the contamination threatening MWD's supply source. MWD's position is simple; let's eliminate any speculation as to the source(s) of contamination so that an appropriate aggressive remediation plan can be implemented to stop the further migration of the plume and best protect public health while minimizing any financial burden to our taxpayers.

Additionally, MWD is very concerned about 1, 4 dioxane levels being identified in the Navy monitoring well sample results. It should be noted that MWD has been advised that the Nassau County Department of Health has petitioned the NY State Department of Health to regulate this contaminate at a much lower level than the present default standard. MWD believes 1, 4 dioxane will be regulated at this lower standard within the timeframe of an expected impact to our public supply wells. As you are aware, conventional wellhead treatment consisting of air stripping and GAC filtration does not effectively remove 1, 4 dioxane and would require additional and / or more costly advanced treatment technologies. For this reason, the public water supply contingency plan measures identified in the NYSDEC Record of Decision (and consent orders signed by both the Navy and Northrop Grumman) will no longer meet the most technically feasible approach to protect public health.

As requested, attached you will find a response to the questions the Navy and NG have asked for prior to working with our experts to develop a sampling plan which meets both the Navy, NG and MWD needs. I am certain you will find the response comprehensive and responsive. Available SOPs and the sampling plan will be provided for concurrence following your acceptance of our request and prior to conducting any field work. Additionally, MWD is not opposed to adding sampling locations to this plan. However, please understand that MWD is a small water district with limited funds so any additional wells being sampled at your suggestion or request should be at the expense of the Navy and / or Northrop Grumman. We would welcome your recommendations. MWD is hopeful that a meeting can be scheduled in early February so that we can move forward with the CSIA sampling as soon as possible. Thank you for your consideration.

Sincerely,
Massapequa Water District


Stan Carey
Superintendent

Cc:
US Senator, Charles Schumer
US Congressman, Peter King
NYS Governor Andrew Cuomo
NYS Assemblyman, Joseph Saladino
US Navy, Lora Fly
USEPA, Judith Enck

USEPA, Doug Garbarini
USEPA, Carol Stein
NYSDEC Commissioner, Basil Seggos
Northrop Grumman, Ed Hannon
NYSDEC, Robert Schick
NYSDEC, Jim Harrington
NYSDEC, Henry Wilkie
NYS Department of Health, Steve Karpinski
Nassau County Department of Health, Joe Defranco
Bethpage Water District, Mike Boufis
South Farmingdale Water District, Frank Koch
NY American Water, Brian Bruce
Hempstead Water (Levittown District), John Reinhardt



220 William Pitt Way
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January 8, 2016

Mr. Stan Carey
Massapequa Water District
84 Grand Avenue
Massapequa, NY 11758

Mr. Carey,

Thank you for the opportunity to work with you on the forensic project at Massapequa Water District (MWD). We appreciate your discussions of the site history, layout, geochemistry and current status. We have received and reviewed your initial request to the Department of the Navy (Navy) and to Northrop Grumman Corporation (NGC). As discussed, we provide the following answers to their concerns to aid you in preparing your response. To establish context we have repeated the original questions, and wherever the original Navy's or NGC concerns are quoted directly, they are in italics.

The following are our itemized responses to the question from the Navy:

1. *"Please explain the basis for selecting the six wells identified in your letter (the five NWIRP wells and the one Northrop Grumman well)." CSIA is only a tool that will produce a new kind of data that augments the data used in the forensic interpretation. Certainly data already exists for the six chosen wells but CSIA is proposed to increase the quantity of available information about those wells. While it would be advantageous to have CSIA data from all wells at the site, it would be questionable site management to collect such a large and extensive data set when the relevant questions could be addressed with a smaller data set. If the interpretation is ambiguous because of the small size of the data set, that will be clearly stated in the interpretive report. Further, if conclusions can be made from the data, a discussion will be included in the interpretive report describing the limits of that interpretation imposed by the size of the data set.*

"Also, how will the results be interpreted? Specifically, what do you expect the CSIA study to reveal about the Navy's contribution to the plume versus potential other sources?" The exact procedure used to interpret the complete data set will ultimately depend on what the data says. As a first step, a plot will be prepared of the $\delta^{37}\text{Cl}$ vs. $\delta^{13}\text{C}$ for the TCE. TCE from a single source will have a linear relationship between these two regardless of degradation, and this can help direct further explorations of the data that will help interpret the data-set. If there are multiple sources, a linear relationship will not exist and this will facilitate exploration of potential contributions by the Navy and other potential contributions.

2. *"The EPA guide enclosed in your letter discusses the use of CSIA in assessing CVOs. Can CSIA also be used to help confirm the source(s) of 1,4-dioxane?"* CSIA can help identify 1,4-dioxane



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(14D) sources, but that requires an additional CSIA analysis beyond that used for other VOC's. 14D contains carbon, hydrogen and oxygen atoms. At this point it is not possible to get a useful measurement of either $\delta^2\text{H}$ or $\delta^{18}\text{O}$ from environmental samples and a $\delta^{13}\text{C}$ value can only be measured for 14D concentrations of 10 $\mu\text{g/l}$ or higher. Since 14D rarely degrades, this is often sufficient for forensic analyses.

3. *"What is the purpose of testing for 1,4-dioxane?"* If 14D presents a hazard, MWD testing for it is only responsible. At concentration that are measurable but are below the NYDOH drinking water quality standards the high solubility of 14D make it a harbinger of CVOC's that emanate from the same source.
4. *"Will you be testing for TCE and 1,4-dioxane only? What isotopes will be analyzed?"* The current plan is to test for 14D, TCE and the TCE degradation products cis-dichloroethene (cis-DCE) and vinyl chloride (VC). Both $\delta^{37}\text{Cl}$ and $\delta^{13}\text{C}$ will be measured for TCE and $\delta^{13}\text{C}$ will be measured for 14D, cis-DCE and VC (If there are sufficient concentrations of 14D, cis-DCE or VC). While Pace Analytical Energy Services (PAES) has been performing CSIA of TCE, cis-DCE and VC for several years the procedures to analyze 14D at the concentrations found at MWD are still being developed. If they can not be finalized before the sampling at the MWD site 14D CSIA will not be done.
5. *"Is the CSIA testing appropriate for the low concentrations of TCE and 1,4-dioxane detected in some of the wells?"* CSIA is appropriate for TCE, cis-DCE or VC concentrations as low as 5 $\mu\text{g/l}$ and 14D concentrations as low as 10 $\mu\text{g/l}$.
6. *"Can the CSIA testing be used to identify specific sources, without characterization of each source of groundwater captured by the northernmost well, which is a pumping/production/ remediation well that captures multiple sources?"* The CSIA data will only augment the data-set being prepared for the forensic analysis. The CSIA data will enable a vector to be produced that points toward likely sources. How it is specifically affected by the current uses of a particular well is such a multi-faceted and complex issue that detailed speculation of it is not appropriate, though it is certainly something to consider and address in the final interpretation.
7. *"Please provide the name of the laboratory that will be conducting the analytical testing. Is the lab currently accredited for the proposed analysis?"* The tests will be conducted at PAES. There currently is no body which accredits CSIA tests. PAES does conduct other tests which are accredited by the National Environmental Laboratory Accreditation Program (NELAP) under the Pennsylvania Department of Environmental Protection. While this is a recognition that we have appropriate quality systems in place and appropriate sample and data management processes, PADEP personnel never reviewed PAES's CSIA procedures.
8. *"What level of validation will be performed on the data? Who will perform data validation?"* Few if any data validators are prepared to validate CSIA data. This increases the quality control burden on the laboratory to insure that their results are defensible and properly documented. PAES policy is that data must be checked by the analyst and a peer before it is issued, and is subject to review by lab managers or directors at some future point.

9. "What guidelines will be used by the data validator? e the method performance criteria that will be used during validation. Will any blanks be analyzed? If so, what kinds and how many? Will any spikes or duplicates be analyzed? What are the acceptance criteria? What are the surrogate/LCS recovery criteria? Please provide acceptance criteria for each." The data is validated at the laboratory in slightly different ways depending on the isotope and analytes. The specifics of that validation are spelled out in the respective Standard Operating Procedures. In general, they involve:
- Inspection of method blanks (unspiked water) run prior to the samples.
 - Evaluation of opening standards against SOP criteria.
 - Making sure the signal is commensurate with that expected from preliminary concentration analyses.
 - Comparison between samples and duplicates of that standard.
 - Matrix spikes are not appropriate for a CSIA analysis and as such will not be performed.

The idea of "recovery criteria" is inherently based on concentration analyses, and is not very useful for CSIA. Rather, CSIA uses different tools for assessing precision and accuracy. Since both the $\delta^{37}\text{Cl}$ and $\delta^{13}\text{C}$ analyses produce results appropriate to $\pm 0.5\text{‰}$ the maximum acceptable differences between samples and duplicates are all 1.0‰ and standards must yield a value different from the known by 0.5‰ or less.

10. "Does the laboratory have current Standard Operating Procedures for the planned analysis? Please provide." The SOPs are provided. Please see the note in response 4 regarding the 14D SOP.
11. "Are there any required detection/quantitation limits the laboratory must achieve?" In 5 above the limits are specified.
12. "Are there Standard Operating Procedures for groundwater sampling that are unique to the CSIA? Are there any special procedures, precautions, or preservatives?" The samples of TCE, cis-DCE and VC do not require any special sampling procedures. They are to be collected just as a routine sample would be collected to measure the concentrations of those compounds in groundwater. Specifically, collect 12 40 ml VOA vials per sample that have been preserved with hydrochloric acid. For CSIA a concentration measurement is required. That has already been included in the bottling requirements for TCE, cis-DCE and VC, but for 14D sampling that means there must be a 1 liter sample collected and field preserved with sodium bisulfite as well as the CSIA sample of 1 liter preserved with tri-sodium phosphate (TSP). The TSP can be added to the bottle prior to sampling.
13. "Will the laboratory be providing sample containers or will the sampling team need to provide them?" PAES will provide all preservatives and sampling containers.

Northrop Grumman Corporation (NGC) brought up several issues in their response and then brought up three bulleted items. While the bulleted items are addressed below it is appropriate to comment first on the general issues NGC raised.

- They characterized CSIA as *"a highly specialized analysis that requires an in-depth understanding of stable isotope behavior to be able to provide a credible interpretation."* Indeed, this is true. MWD has employed Dr. Patrick McLoughlin to provide the interpretation and he has earned that level of understanding and can provide a credible interpretation. Further, to provide scientific validity, Dr. McLoughlin's interpretive report will be reviewed by Drs. Robert Pirkle and Aaron Peacock.
- Concern was also raised that "CSIA is far from the relatively straightforward procedures and protocols used for standard parameter sampling analysis, quality control and data interpretation." This is true, but with proper caution and effort, all of these things can still be done and done well. In fact, often with just a little guidance, standard protocols can readily be used. As an example, consider sampling: while the sampling required for CSIA of perchlorate is both unique and complex, the sampling for volatiles such as TCE is done by the same procedure that is regularly used to sample groundwater for TCE concentrations.
- NGC stipulates *"MWD's work plan should be consistent with the applicable procedures and protocols in USEPA's A Guide for Assessing Biodegradation and Source Identification of Organic Ground Water Contaminants using Compound Specific Isotope Analysis (CSIA) (EPA 600R-08/148, Dec. 2008)"* Dr.'s Pirkle and McLoughlin were scientific reviewers of that guidance prior to its final release. They based the quality control program for CSIA at PAES off of the recommendations in that guidance and it is followed where applicable, but it should be remembered that document was prepared at least seven years ago. The use of CSIA in tracking groundwater forensics has advanced considerably in that time. While it is a very good guidance, it is not all that will be used. For example, one reference that will be used is the Technical and Regulatory Document assembled by the Environmental Molecular Diagnostics Team of the Interstate Technology and Regulatory Council. (ITRC. 2013. Environmental Molecular Diagnostics, New Site Characterization and Remediation Enhancement Tools. EMD-2. Washington, D.C.: Interstate Technology & Regulatory Council, Environmental Molecular Diagnostics Team. www.itrcweb.org.) Another document that will be used is the "Environmental Isotopes in Biodegradation and Bioremediation." (Aelion, C. M., P. Höhener, D. Hunkeler and R. Aravena. 2010. CRC Press, Boca Raton). In addition journal articles will be cited in the report to support conclusions that are not addressed in the above.
- NGC requests that a *"discussion be provided of the qualifications and experience of its selected laboratory and technical consultant in conducting CSIA analyses and data interpretation."* The analyses will be conducted at Pace Analytical Energy Services (PAES) in Pittsburgh, PA (220 William Pitt Way, Pittsburgh, PA 15238). In 2012 Pace acquired Zymax Forensics Laboratories. The following year Pace acquired Microseeps, Inc. These two companies were combined to form PAES and their legacy companies have been providing CSIA since 2006. They have processed thousands of samples. Drs. McLoughlin and Peacock were members of the ITRC team that prepared the Environmental Molecular Diagnostics document (Drs. McLoughlin and Peacock were joined by Dr. Yi Wang, who is also at PAES and will also be involved in this project but not in the interpretation.) Dr. McLoughlin has written several dozen interpretive reports that use



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CSIA of ground water samples to investigate forensics, and those reports are routinely reviewed and tested by Drs. Peacock and Pirkle. Their resumes are provided.

The following are our itemized response to the issues raised by Northrop Grumman Corporation:

1. *"The isotopic composition of the compounds of interest may have changed with time due to changes in manufacturers, manufacturing process and changes in stock materials used in the manufacturing processes. Please specify how the testing regime will account for this issue."* This is true, these are some of the potential sources of any observed change in isotopic composition. This should be reflected in any interpretation of CSIA data, but the analytical process is entirely independent of the interpretation.
2. *"Given the extent of the plume there are questions about whether CSIA can be used to adequately characterize the plume without perhaps 30 or more ..."* The degree of sampling required to characterize a plume is a function of the questions that characterization is meant to help answer. The high number of samples suggested may well be required to address forensics in high resolution where there are many sources and there are multiple transfers of liability, but the historical record does not indicate such complexity. If the data collected does not represent a sufficient sampling plan the interpretation will be inconclusive. But if a conclusion can be made and is properly supported, the interpretation must discuss the limits that sampling plan puts upon the conclusion.
"Moreover because Well 1 is under pumping conditions ..." It is understood that this well is being pumped and if the contaminants of the site are not the primary source of the contaminants in Well 1 the isotopic composition of the contaminants in Well-1 may be different from the other parts of the site. This is also something that must be accounted for in the interpretation.
3. *"There is limited published literature available on 1,4-dioxane. In particular, there are no published studies regarding potential changes in the stable isotopic composition of 1,4-dioxane due to microbial degradation. Therefore, interpretation of CSIA results for 1,4-dioxane may be difficult. Please suggest the methodology for any analysis of 1,4-dioxane that MWD intends to perform."* The interpretation must account for the paucity of published literature about the isotopic effects of microbial degradation. However, it is already clear that microbial degradation of any compound does not produce a "step change" in the isotopic composition but a change whose magnitude is a continuous function of the extent of that degradation. The study proposed at MWD is intended to look for any change and only to hypothesize about the extent of those changes and the potential origin of them.



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We recognize that there are considerable interests involved and we want to approach this with the most honor, openness and scientific rigor that we can provide. We appreciate the reviews all parties have provided and welcome the opportunity to participate in the discussion.

Sincerely,

A handwritten signature in cursive script, reading 'Patrick McLoughlin'.

Patrick McLoughlin, Ph.D.

Technical Director

Pace Analytical Energy Services